Involving Engineers in User Research and User Experience Design of ICT for China

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Abstract. Chinese culture and consumer patterns are dramatically different from those in the US and Europe. That greatly impacts the types of products that are relevant to the Chinese market, the product development life cycle and methods by which these products are defined and developed for information and communication technologies (ICT). To address those unique differences, the User Centered Design (UCD) research team at Intel China has developed and refined techniques for involving engineering staff in the early stages of product design, namely user research and experience design. This early involvement has many advantages and improves the overall effectiveness of the product development team. This article describes the role of the engineers in the early phases of the user centered process, and the learnings and challenges that come from this approach. Real-world case studies are used to illustrate the methodologies.

Keyword: ICT, user experience design, user centered design, user centered research, ethnography, brainstorming, field work.

1 Introduction

China, with its huge population and rapidly growing economic development has drawn the attention of the world as a huge new market and an opportunity for growth for companies that are able to capture some of that market. Many reports indicate that China is currently the second largest computer market not far behind the United States. ICT products like computers and mobile phones are quickly becoming an integral part of daily life for many Chinese.

As China opens its doors and markets to the world, major differences in culture, lifestyle and behavioral patterns render many proven Western and mature market business and commercial practices ineffective for China. Numerous reports and studies attempt to demystify China, but many of the new entrants in the Chinese market are often unsure of how to tackle this market. The market environment characterized by rapid growth, fierce competition, China unique considerations and fast changing consumer tastes also demands agility and a short product life cycle for product developers. Thousands of new products are flowing into the market everyday with most of them quickly moving out of fashion. That means that user research plays an even

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more important role in new product design and development: it requires an integrated understanding of market opportunity, the business ecosystem and user needs.

User research based on ethnographic methodologies have become increasingly popular in the field of human computer interaction (HCI) to inform product definition and span the product development life cycle from understanding user needs, to formulating relevant user requirements, defining user experience that responds to the need, product and technology development as well as the evaluation of new products and services.

The research practice of ethnography in China, and especially its use in an industrial context, has a relatively short history compared with the United States and Europe. The methods originated from the Western society are mostly based on Western culture and models of thought. So we are facing challenges in adapting these research methods for user research aimed at the product development for Chinese market. [4]

One big challenge is that academic ethnographic research in its purest form is very time intensive. "Typically, ethnography will take place over a period of several months with at least the same amount of time spent in analysis and interpretations of the observations [1]". But it is almost impossible to spend months or even weeks in the field gathering data in the fast moving commercial world especially in China. Pressures of time to market, people and budgets force trade-offs to be made in the way research is conducted. [6] Those constrains are greatly impacting research design by keeping the focus on the real goal: to generate relevant and reasonably accurate product design and engineering requirements that can be developed into commercial products. Rather than exploring human condition in great detail, commercial application has to zoom in on the most important activities as opposed to create full context ethnographic research.

And Even more important is that user research really needs to be conducted by professionals with anthropology, psychology or sociology backgrounds, so one question that needs to be addressed is how to narrow the gap of interpretation of the research findings and user experience design to engineers and designers who are expected to act upon those findings. It's always a big challenge for researchers to translate their findings into engineering product or technology design requirements. There are many good methodologies developed in the HCI field involving the use of personas, story boards, use cases and usage scenarios, and models to name a few. But we are always looking for other techniques that are most effective at helping engineers better understand the meaning of the research to lessen the gap between the different functional disciplines on a product development team.

In short, what's needed is a research methodology that is cost-effective, provides a good basis for communication, is easy to act on by the different functions and really helps inform product design. This paper describes the methods we used in our research work in China for an ICT product developed in 2004. These methods specifically involved engineers in the early stages of product definition. As will be explained, they were quite active even in the user centered research work.

2 Why We Need Engineers to Be Involved in User Research

Generally, engineering participation in the product definition process creates a deep sense of co-ownership and buy-in into the product ideas by the technologists

involved. Engineers who participated in the user experience definition would also be expected to fully participate in user research work. By involving engineers in the user research phase a project can really achieve the effect that "when the creative process is conducted as a truly integrated, mixed-discipline collaboration versus an *engineering project*, the resulting product concept that emerges is usually far superior and makes better use of technologies."[2]

From user researchers' side, they are usually not well-versed in technology. It's especially obviously in China as we mentioned that the use of HCI user research in China has not well-established yet. So it can be a barrier for Chinese local researchers to catch crucial insights to inspire the technology innovation during user research phase. The mix of technology expertise into research work to offset local researchers' weakness on such knowledge is necessary. Engineers' technology background can help research in identifying key questions that contribute to technology development. The presence of engineers and designers, helps appropriately focus the field research before and during the field work which in turn can reduce the total research time and cost.

Engineers, of which there is no shortage in China, but overall tend to be less comfortable and skilled at interpersonal communication as the traditional culture teaches people to be modest, show respect for others and focus on one's own responsibility. People are sometimes too modest and polite to readily share ideas in open brainstorm sessions. Critique of someone else's ideas is often perceived as un-professional, even personally offensive. However innovation work relies heavily on the team's interaction rather than individuals working independently. The involvement of engineers in user research phase is essential to build an environment that encourages wide open communication, that allows people to be open minded and where organizational authority between participants can be temporarily put aside.

Earlier involvement of engineers helps them see and understand the real world user needs and environment directly. That helps engineers better appreciate ideas and concepts created in response by user experience designers that they might otherwise consider as too wild and too difficult to implement. They can start thinking from the users' perspective instead of getting secondary research data reported by the researchers. It creates empathy among the engineers for the user and their problems. That helps overcome the stereotypical behavior where "engineers and technologists often continue to take a one-sided technology view of what the world needs."

The advantages of earlier involvement of engineers is obviously now. When placing engineers among the real users and the environment in which the product will have to operate, they can have very effective interaction with user researchers in driving them to articulate additional questions that will help them shape product design and resolve engineering tradeoffs. And it provides a good basis for better communication between researchers and engineers in product development that helps shorten the total development time and deliver even fancy product to pursue users' value.

3 How to Involve Engineers in User Centered Research Work

To involve engineering people in product definition has a long history in Intel. While by the user research practice in China, engineers are even involved in earlier stage: the user

research phase. It helps to be explained by looking into Intel's UCD process. (Fig. 1) Within Intel, the UCD process can be broken down into roughly four phases [2]:

The first phase is *to understand people by user research.* Generally speaking, we capture insights from observation of users, identify user's goals and needs, discover value proposition and context constraints which are used to inform and inspire the definition team.

Then is the second phase, *define the user experience*. The goal of this phase is to define the external user-observable behavior of the product to be developed.

The third phase is to *translate into engineering requirements.* Here, high level *external* product requirements are translated into quantifiable and concise technical engineering requirements that are directly actionable by engineers and later testable.

And the last phases, develop*, integrate, productize*. The real engineering work and technology development happens in this stage.

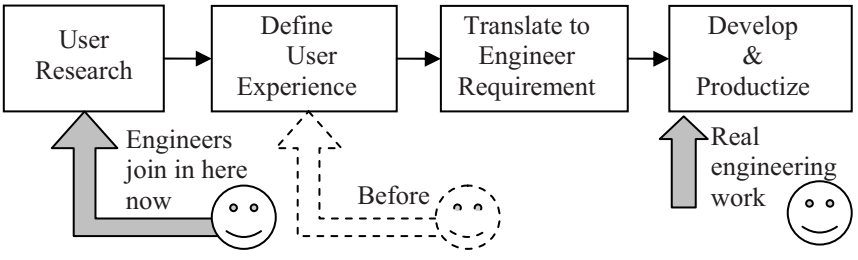

Fig. 1. User Centered Design process and the phase to involve Engineers

Of course, taking engineers into the field can be a bit of a challenge to most researchers, as engineers lack the research knowledge such as proper interviewing techniques, how to interact with the study subjects, and so on. They are usually overly focused on technology specifics as opposed to for example understanding more subtle social interactions and deeper motivations that should also be a major part of good field work. We will next introduce the process and some techniques that help engineers to be fit better with the field environment.

3.1 Phase 1: Homework

This stage allows the engineers to ramp up in thinking from the user viewpoint. We ask the engineers to execute some simple tasks that the trained researchers designed for them. All the activities are for a single task, a clear objective, offer a low time duration and are easy to complete. It's a very effective approach for engineers to start understanding people as people by acting as a user, thinking as a user or observing a user's activities.

3.1.1 Short Story Telling

This technique is used most frequently in our practices. It gives several questions for engineers for which they have to find the answers from target users. These target users don't need to be as accurate as the real target user we have defined; it could be

anyone having a related experience with the implied technology. The users to interview are easy to find and talk with. It could be their family members, friends, neighbors, or, while not ideal, they could even use themselves as the target users. The questions they are given include three categories:

1. Story of a bad experience of technology use. This is a very short descriptive question that to which it should be easy to generate a story like answer. These questions help the engineer determine a user's unmet needs or broken expectations with current technology.
2. Good experiences with using technology. These questions help explore what the user values in technology, what technology means to the user, and how it impacts their life.
3. Ideal product or technology that could improve the usage they described earlier. These questions are aimed at determining the ideal desired experience for the user.

3.1.2 Map of a Typical Day in the Life

We provide pictures, magazines or sticks with symbols and text to the engineers. They are then asked to use these materials or anything else they can readily find to create a map of their typical day involving the use of technology products. They can even take photos of what they do as they use technology products. The map has to include key elements such as time, place, what they are doing, what technology they are using and how they feel about it. [8]

3.1.3 Photo Journal

In a similar technique we give engineers a topic and ask them to take photos to best describe it. For example they may be asked to take photos of how people use a certain technology product, take photos of their favorite technology product or the product they used most frequently.

From creating the stories or map of their typical day of life engineer is starting to think what technology means to the person using it and also how they use it. We are not targeting on finding real user needs and context through these parts to shape an actual product, but they are an effective introduction to user research work for engineers.

3.2 Workshop Discussion

After team member finished their homework, all the results are taken into a workshop for discussion. This is aiming at providing an environment that encourage people open discussion, sharing information and generate idea systematically. In the workshop session team members show and tell the stories of their work one by one, and others ask short questions after each 2-5 minute presentation. With this sharing of data, everybody get more stories of technology use and user problems. This is followed by a brainstorming session that explores several elements: user needs, possible solutions, areas that need additional understanding and would require follow-on user research. The discussion can become very intense as everybody really fully engages in the creative process. The final part of the workshop is to categorize or clump the brainstorming results and listing the key areas where further research in needed. (Fig. 2)

Fig. 2. Category user need in workshop

Fig. 3. Conduct user observation with engineers

After the workshop, the team ends up with a relatively crisp requirements list for designers and engineers resulting from the research work, and more research questions for researcher to get answered. Based on the latter, researchers can form a research plan and protocol for field work. Similarly, engineers can start technology design based on the user-level requirements list. Their direct involvement in the creation of that list makes it easy for them to also appreciate the underlying motivation for those requirements. The advantage is clear: every functional discipline walk out with a clear direction for their next steps and project time saved as everybody are working of a shared understanding of who the target user is, what user problems are to be addressed, why the requirements have been selected. It all happens in parallel and at the same time; nobody has to wait for others to deliver results for their next step.

3.3 Boot Camp

Boot camp is a basic training preparation for people prior to joining the field work. The research protocol is discussed and finalized, non-researchers are trained on research principles and ground rules such that they will behave properly during the field work. We also use techniques for make impressions of these research principles to engineers.

3.3.1 Field Scenario Role Play

Two trainers act as informant and researcher respectively, they show appropriate behavior and also inappropriate behavior by acting out specific scenarios that simulate how real scenarios can happen in the field.

Sometimes we also ask engineers to act as the researcher while the trainer acts as the informant and go through a short part of research guideline, the rest of the audience will help to identify the problems during the simulated “research field work”, and the trainer will provide comments after that.

As the research plan and protocol are designed for maximum effectiveness, every person on the field research team will be assigned a role and responsibility in the field during boot camp. Then everybody including the engineers is ready to head out.

3.4 Structured Field Work

We call it *structured* field work because engineers do not participate in all aspects of the field work the way trained and experienced user researchers do. Researchers still take responsibility for most of the field work as usual for obvious reasons. Engineers only participate in the sessions scheduled near the end of all the field work sessions. These sessions are designed to be one to two days in length and include visiting key sites and interviewing key informants that have been carefully selected by the researchers from the earlier field work sessions. That selection is expected to "make the most" of the field time and to improve the field data collection with both abundance of data and the chance that interesting events and objectives will be observed.

Several activities occur in the structured field work sessions include: structured interviews, activity walkthroughs, and contextual inquiry. The “map of a typical day” technique we mentioned earlier is frequently used here to ask the informant to describe their typical day. We also ask people to show us their technology products and describe how they’re actually used; even ask them to show us how they use their desktop computer to do specific tasks such as download an MP3 file to their digital audio player.

By using those research techniques in structured field work, researchers present their findings to the engineers in the real end user environment. (Fig. 3)This natural setting provides for a much richer representation of the research findings and makes it easier for the engineers to makes sense of the situation. And discrepancies and gaps in understanding of the research insights can be readily be illustrated and resolved. In the same time the impact of having the engineers observe and interact with the informants at that location allows them to generate key insights for themselves that often directly drive aspects of the design and engineering requirements. Often the engineers are more likely to pay attention to some the more technical aspects of the context.

After completing each field work session, a short discussion should be held to improve the protocol and justify the research activities before the team starts the next field session. This is repeated iteratively and the research results are consumed in the concept brainstorming process. After a few iterations, there are no additional unanswered research questions and the resulting concepts can be considered stable. (Fig. 4)

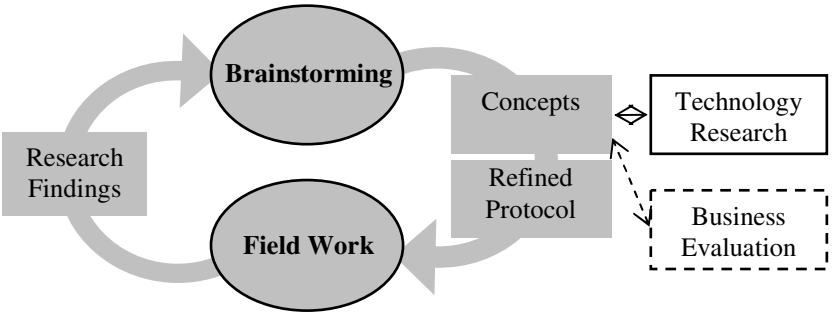

Fig. 4. Structure of engineers participated field work

It's interesting to highlight why this method is well suited for Chinese culture. Chinese people are usually not likely to express their opinions without fully understand the real purpose. They seem closed the first time you meet with them, and they will not likely be forthcoming in answering sensitive questions. As people become more familiar with each other, they also become very warm-hearted and willing to reveal much more about themselves and their feelings. So a good informant replies heavily on the personal relationship that is built up during the research activity. Once that relationship and trust is in place, research findings become much more interesting and insightful to the point that we consider these informants as key informants [3], and they are going to share more and more important ideas when keeping a good relationship with them.

Our results with engineer participation in field research is very encouraging, they are constantly surprised by the abundant information they collect while in the field and really recognize that what they used to think about the user is quite different from what they observed and heard from users by being there. This instills a profoundly different attitude in the engineers that positively impacts their further development work and they also learn to appreciate much more the value and importance of other research results in which they did not themselves participate. All this helps foster a good working relationship within the cross-functional development team, since everyone on the team is focused on a common goal.

4 Case Study

We'll next take a look at a project named "gaming engine". The objective is to design a product for China internet café to improve young people's gaming experience.

Engineers were asked to search for answers to three questions at home:

- Please tell us a story of your most exciting/ happy experience with gaming
- Please tell us a story to describe an unsatisfied area about any of the existing gaming machine that you are using (can be: PC, gaming console, mobile, or other)
- Please tell us a story about your dream of the ideal gaming experience

Engineers tend to take their work very seriously. They took a lot of interesting stories into discussion. One mentioned that it's really exciting that his friends in the dorm built their LAN together and play against each other for LAN-based action gaming in the university. Another one mentioned that the ideal gaming machine should have a function like "love seat" in cinema, so couples or boy and girl friends could play together.

During the workshop discussion, teams were asked to present their story of good and bad experiences. All the stories were pasted on the wall and broken into two categories: good experiences and bad experiences. The team then discusses these two categories respectively. In the good experience category, we are trying to highlight what satisfied the users; what is valuable to them. In the bad experience category, we find out users' unmet needs and capture them as to keywords with paraphrasing.

After highlighting user value and unmet needs, the team members were divided into two teams to design a "gaming concept" based on the output of the team's discussion, and present the concept back to the team with sketches and a brief description. After the two concepts have been presented, the team holds another round

of discussion to improve the concepts and bring up new questions for user research as well as areas for technology study as a next step.

The user research work was designed as a combination of home and site visits, with in-depth interviews and focus groups. There's no doubt that engineers have no problem being involved in observing in-depth interview and focus group as they are in the safe zone behind the one-way mirror. But also in home and site visits, engineers tend to follow the process and protocol and contribute many good ideas to team.

We found that engineers are very surprised by the research findings they get from personally participating in the field work. For example, before the field work, performance (speed) was always assumed to be the biggest concern for young gamers, so our efforts focused on performance almost exclusively. The research surfaced other and different needs that pointed at the importance of other aspects that are key to successful commercial solutions. Although performance is still very important, meeting the social need around gaming is driving a new and different set of requirements. We found that the personal presence in the gamer community is very important. To go out with friends for LAN-based gaming is a very common social activity for them and feedback from online gamers is that they are sometimes seeking a kind of social relationship that is different from the real world. The social purpose has driven the team to think and develop solutions that enhance group communication for gamers.

With the collaboration of engineers in user research and user experience design, the development team went through the work more smoothly and everybody was passionate to devote their talents to the product that users really want.

5 Summary

With the reality of constraints such as timing, people and budget of product development projects, the method of involving engineers into the earlier stages of user centered product innovation provide an approach that shortens the development life cycle and fosters improved interaction between different functional disciplines involved in development.

The method is developed and refined in the context of ICT product design in China, but it could easily be adapted to any geography by adjusting for local culture differences.

Research technologies can also be introduced during research that can help engineers participate productively in user research stage besides the methods mentioned in this article. For example: by capturing video documentary of the session or by capturing an audio record, or take still pictures. [7] The data can then alter be filtered and condensed by trained researchers. Researchers should trade-off the methods used based on the resources available to them.

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